FAA-P-2568
August 28, 1973

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
PURCHASE DESCRIPTION

CIRCUIT BREAKER TEST SET, 4000 AMPERE

1. SCOPE

1.1 Scope. - This purchase description sets forth the requirements for a circuit breaker test set used for testing interior mounted breakers with coil ratings up to 4000 amperes.

2. APPLICABLE DOCUMENTS

2.1 Federal Aviation Administration documents. - The following FAA document of issue specified in the invitation for bids or request for proposals, form a part of this purchase description and is applicable to the extent specified hereinafter:

FAA-STD-013 Quality Control Program Requirements

2.2 Military documents. - The following Military document of the issue in effect on date of the invitation for bids or request for proposals, forms a part of this purchase description and is applicable to the extent specified hereinafter:

MIL-E-17555 Electronic and Electrical Equipment, Accessories and Repair Parts; Packaging and Packing of

2.3 Other Publications. - The following publication, of the issue in effect on the date of the invitation for bids or request for proposals, forms a part of this purchase description and is applicable to

the extent specified herein:

NFPA NO. 70 National Electrical Code

(Copies of this purchase description and of the applicable FAA documents may be obtained from the Contracting Officer in the Federal Aviation Administration office issuing the invitation for bids. Request should fully identify material desired, i.e., documents numbers and dates, together with amendment numbers and dates, where applicable. Request should cite the invitation for bids or the contract involved or other use to be made of the requested material.)

(Single copies of Military documents may be requested by mail or telephone form U. S. Naval Depot, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120 (for telephone request call 215-697-3321, 8 a.m., to 4:30 p.m. Monday through Friday.) Not more than five items may be ordered on a single request; the invitation for bid or contract number should be cited where applicable.)

(Information on obtaining copoies of NFPA publications may be obtained from National Fire Protection Association, 60 Batterymarch Street, Boston, Mass. 02110.)

3. REQUIREMENTS

3.1 Equipment to furnished by contractor. - Each test set furnished by the contractor shall be complete and ready for operation in accordance with the main and required characteristics set forth herein. Each test set shall include, but be not necessarily limited to the following:

(a) Circuit breaker test set (3.4.1)
(b) Timer (3.4.2)
(c) Stab adapter board and stab sets (3.4.3)
(d) Housing (3.5)
(e) Instruction books (3.6)

3.2 Main and required characteristics. - The test set specified herein shall provide a variable high current output and incorporate all control circuitry and instrumentation necessary to test and calibrate circuit breakers with coil ratings up to 4000 amperes. To accomplish this, a multi-tapped double wound transformer providing a wide variety of output taps and a variable transformer with an unlimited choice of currents shall be integral with the test set. This test set shall be capable of simulating overload and ground fault conditions and measuring pick-up, reset and time-current characteristics of long-time delay, short-time delay, and instantaneous trip elements. The test set shall be capable also of ratioing current transformers and primary injection testing of high voltage circuit breakers and the associated protective relay and testing thermal and magnetic motor overload relays.

3.3 Service and test conditions

3.3.1 Service conditions. - The term "service conditions" is defined as the group of parameters listed under (a) and (b) below. The standard design-center values are shown in parentheses below for identification of the applicable service conditions ranges. Similarly, the applicable ambient conditions shall be those in the list under (b) corresponding to the environment:

(a) AC line parameters, elevation, and duty:

(208 V)	177 V to 239 V	(± 2 V) **
(230 V)	195 V to 265 V	(± 2 V) **
(460 V)	391 V to 529 V	(± 4 V) **
(575 V)	489 V to 661 V	(± 5 V) **

**NOTE: Where discrete values of the above frequency or voltages are specified for testing purposes, the tolerances given in parentheses shall apply to these parameters as they are indicated on the measuring instruments.

AC line frequency (60 Hz)	57 Hz to 63 Hz (±0.2 Hz) **
Elevation	0 to 10,000 ft. above sea level
Duty	Intermittant, attended

(b) Ambient conditions:

Temperature	+10°C to +50°C
Relative humidity	10% to 80%

3.3.2 Normal test conditions. - The term "normal test conditions" is defined as a group of parameters consisting of the ambient temperature and the applicable voltages, with permissible tolerances as listed below. These tolerances apply to the parameters as they are indicated on measuring instruments.

PARAMETER	TOLERANCE
Temperature 25°C	± 5°C
208 V	± 3.5 V
230 V	± 4 V
460 V	± 8 V
575 V	± 10 V
60 Hz	± 0.5 Hz

3.4 Electrical configuration

3.4.1 Circuit breaker test set

3.4.1.1 Output current. - The test set shall provide continuously adjustable output current of the values listed below, when stab adapter board and stabs are used.

Output current	Maximum Time ON	Minimum Time OFF
0-10,000 amperes	30 minutes	30 minutes
15,000 amperes	150 seconds	8 minutes
25,000 amperes	10 seconds	3 minutes
35,000 amperes	1 second	2 minutes

3.4.1.2 Ammeter. - A high quality precision ammeter shall be incorporated into the test set. This ammeter shall be capable of measuring the short duration currents involved in testing the instantaneous trip of circuit breakers. It shall have three scales and 7 switch selected ranges. These ranges shall measure currents from 0 to 50,000 amperes. The overall accuracy shall be $\pm$ 1% of full scale.

3.4.1.3 Overload protection. - Built-in overload and short-circuit protection shall be provided in accordance with Article 240 of NFPA No. 70.

3.4.1.4 Line Voltage. - The test set shall be able to operate on single phase line voltage of 208/230/460/575 volts. The line frequency shall be 60 hertz.

3.4.1.5 Timer control circuit. - The test set shall have a timer control circuit which can start the timer when the output is energized, stop the timer when the breaker contacts open or close, and de-energize the output. For testing a breaker with no auxilliary contacts to monitor, a current actuated circuit must start and stop the timer. The minimum pick-up sensitivity shall be 100 amperes and be operational up to 35,000 amperes.

3.4.2 Timer. - A electronic digital timer to measure the elapsed time of the test in both seconds and cycles shall be provided. It shall be well shielded and have noise suppression circuitry. The required accuracy (0 C°to 50°C) is $\pm$ 0.0025% of reading for the "seconds" mode and $\pm$ 1 cycle for the "cycles" mode. Two switch selected ranges shall be provided: 0 to 1999.99 seconds and 0 to 199999 cycles. The digital display shall provide one-half inch high numerical characters.

3.4.3 Stab adapter board and stabs. - A stab adapter board and stabs shall be provided as a means of directly connecting the circuit breakers to the test set. Their purpose is to provide maximum utilization of the available output current from the test set by eliminating the significant losses that occur if test leads are used. Since design of the stabs are dependent upon the type and manufacturer of the circuit breaker to be tested, the stabs shall be furnished for the breaker types and manufacturers listed in the contract schedule. As a minimum, the test set shall provide capability to test manufacturers standard devices within the stated rating limitations which have been manufactured by the following:

General Electric Company
Westinghouse
Allis Chalmers
I.T.E. Imperial Corp.
Federal Pacific

3.4.4 Grounding requirements. -

3.4.4.1 Personnel protection from line-input terminals. - All AC line-input terminals (120 V AC or higher, design-center rating) shall be covered by barriers or guards for protection of personnel servicing the equipment (not applicable to receptacles or other plug-in devices).

3.4.4.2 Discharging Devices. - Within two seconds after breaking the power or opening the interlock, high voltage circuits and capacitors shall discharge to 30 volts or less. This requirement shall apply even if electron tubes/semi-conductors, which normally draw current from the high voltage circuits, are removed from their sockets. If protective devices are needed to meet this requirement, they shall be positive acting, highly reliable, and shall operate automatically when power is removed or the interlock opened.

3.4.4.3 External parts. - Design and construction shall be such that the outside casing and frame of units, i.e., all external parts, including all shafts and controls projecting through panels, panel bushings, and all other portions of the equipment available to an operator without opening access doors, shall be at ground potential when the equipment is installed and in operation (except as specified in 3.4.4.4.1). For th purposes of this paragraph, access doors are those usually opened for servicing purposes, such as the hinged doors in rack panels, and the rear doors of cabinet-type racks. Front panels (including the operating controls thereon), which are located behind front doors of equipment cabinets, including cabinet-type racks having front doors, are within the meaning of external parts above, and shall be at ground potential as specifed.

3.4.4.4 Parts cases. - All outer metal cases of parts such as capacitors, transformers, etc. shall be at ground potential, except as provided in sub-paragraphs below.

3.4.4.4.1 Cases at above-ground potentials. - In circuits where the standard metal case of a part is operated at potentials greater than 100 V peak to ground, a grounded metal casing or a casing made of insulating material shall be added. This external casing shall enclose the original case on all sides except the terminal side.

3.4.4.4.3 Cases insulated from ground and other potentials. - Where a part case is insulated from the part terminals, grounding of the case is not mandatory, provided the case is insulated from all potentials.

3.4.5 Interlock requirements; basic. - When compartments, cabinets, racks, panels, etc, have doors, covers, or shields, which are normally opened for adjustment or maintenance, interlock switches shall be provided to remove all voltages of 150 V and higher made accessible by opening or removing the doors, covers, or shields, with the following exception: Where access

to secondary (internal) covers or shields is through primary interlocked doors, covers, or shields, interlocks are not mandatory on the secondary covers or shields if the voltages exposed by the removal thereof are not in excess of the following limits, with the primary access door, cover, or shield open:

Primary Interlock Status	Voltage Limit Back of Secondary Cover or Shield
Effective (unbypassed)	Less than 150 V
Bypassed	300 V

3.4.6 Special Tools. - The test set shall be supplied with a complete set of special or unique tools that may be required to service, calibrate and maintain the test set in operational order.

3.5 Housing. - The following requirements shall be met.

(a) The test set may be housed in two completely self contained metal enclosure units consisting of a Control Unit and a Power Output unit.
(b) These enclosures shall be grounded in accordance with Article 250 of NFPA No. 70 and paragraphs 3.4.4 thru 3.4.4.4.3 herein.
(c) A sign saying "CAUTION: This unit must be grounded before operating" shall be mounted on each enclosure.
(d) High voltage caution signs saying "DANGER HIGH VOLTAGE (maximum voltage applicable) VOLTS" shall be mounted on the enclosures.
(e) The interlock requirements of 3.4.5 shall be met.
(f) Large Castors shall be provided on the bottom of each unit to enable the test set to be rolled to different locations.
(g) Heavy duty eye-hooks for lifting.
(h) Dimensions shall be such that the units can be moved through 2 ft. 8 inch wide personnel doors without necessity of removing doors or accessory hardware.

3.6 Instruction books. - Two commercial quality instruction books shall be provided with each test set in accordance with the contract schedule. Material content and presentation shall be submitted for approval within 30 days of contract award to assure that the printed books are delivered concurrently with the test sets. The book shall contain, as a minimum the following information.

(a) Equipment Summary and Description
(b) Theory of Operation
(c) Operating Instructions
(d) Calibration and Maintenance Instructions

(e) Parts Location Identification
(f) Parts List
(g) Schematic Diagram or Wiring diagram
(h) Photographic Views of Equipment (at least two)
(i) -Not Used-
(j) List of common tools (required to service and calibrate)
(k) Cover Page or Plate stating at least the following:

(1) Manufacturer's Name and Address
(2) Title of Equipment
(3) Manufacturer's Type and/or Model Number
(4) Contract Number and Date
(5) Contractors Name and Address

(l) Contract Guarantee clause
(m) Troubleshooting and Testing Procedures

3.7 Test equipment

3.7.1 Furnishing of test equipment. - The contractor shall supply all the test equipment necessary for the required tests.

3.7.2 Basic instrument accuracy. - Instruments for measurement of certain basic electrical quantities shall have the rated accuracies specified in the following table, or better (instrument manufacturer's rating or testing laboratory certification). The percentages given in the table for indicating instruments are percentages of full scale. All readings shall be made within the upper 50% of the scale arc.

Electrical Quantity	Accuracy
Resistance (see Paragraph 3.7.3).	
DC voltage, current, power	±0.5%
AC voltage, current, power at 60 Hz (except filament/heater voltage)	±1.0%
Filament/heater voltage	±0.5%
Frequency, AC line (60 Hz)	±0.5%

3.7.2.1 Allowance for less-accurate instruments. - As an exception to the requirement for rated accuracies in accordance with the table of 3.7.3, the contractor may use instruments which are less accurate, up to a limit of twice the percentage values shown in the table, but only for the measurement of an electrical quantity for which a tolerance is specified, and provided that the additional instrument tolerance shall be subtracted from the tolerance specified for the electrical quantity. For example, a contractor uses a 1% AC voltmeter for measurement of filament voltage where filament voltage tolerance is ±3%; required instrument accuracy from table ±0.5%. The additional 0.5% instrument tolerance is subtracted from 3% giving 2.5% as the required filament voltage tolerance when using the 1% instrument.

3.7.3 Resistance-measuring equipment. - For measurement of resistors having a rated accuracy of ±2% or better (also to measure resistors of lesser accuracy to resolve questions where tolerances are apparently exceeded by a

small margin), and for measurement of transformer and other parts windings for determination of temperature rise by the rise-in-resistance method, a Wheatstone bridge having components equal to or better than the following shall be used:

Rated accuracy of ratio resistors: ±0.05%
Rated accuracy of arm resistors: ±0.1%
Rated sensitivity of galvanometer: 1 uA per millimeter

3.7.4 Temperature indicators. - Temperature indicating equipment shall have an accuracy ±2°C or better.

3.7.5 Humidity measurement accuracy. - The technique used to measure relative humidity shall provide readings within five percentage points of true relative humidity.

3.7.6 Instrument accuracy for other measurements. - Instruments for the measurement of electrical quantities other than those specified in 3.7.2 to 3.7.3 above shall have actual calibrated accuracies greater by a factor of three (as a minimum) with reference to the tolerance specified for each electrical quantity.

3.8 Maximum weight and size. - The maximum total weight of the test set shall be 2800 pounds. The maximum total volume shall be 75 cubic feet.

4. QUALITY ASSURANCE PROVISIONS

4.1 General. - The requirements of FAA-STD-013 shall be applicable hereto. All tests and inspections to determine compliance with the electrical and mechanical requirements of this specification shall be made by the contractor and shall be subject to Government inspection. The term "Government inspection," as used herein, means that a FAA representative will witness the contractor's testing and inspection, and will carry out such visual and other inspection as deemed necessary to assure compliance with contract requirements. The Government reserves the right to waive Government inspection at the contractor's plant.

4.1.1 Normal testing conditions. - Except where otherwise specified, all testing shall be done under normal test conditions.

4.1.2 Environment testing. - The contractor shall demonstrate on one test set, chosen at random by the FAA inspector, that all requirements of this purchase description can be met under the service conditions as specified in para. 3.3.1.

5. PREPARATION FOR DELIVERY

5.1 Preservation, packaging and packing. - Preservation, packaging and packing shall be in accordance with MIL-E-17555, level C.

6. NOTES

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